



**National Aeronautics and
Space Administration**

**Office of Safety and Mission Assurance (OSMA) Software
Assurance Research Program (SARP)**

**Level I Technical Program Plan
(FY04 - FY06)**

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OSMA Software Assurance Research Program Level I Technical Program Plan

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1.0 INTRODUCTION

1.1. Purpose

As part of the Office of Safety and Mission Assurance (OSMA) Program Operating Plan (POP) for FY 2004, this Level I plan solicits participation of NASA Center personnel in the OSMA Software Assurance Research Program (SARP). Additionally, it describes the program's goals, objectives, and implementation strategy for FY04 – FY06.

1.2. Program Background

Sound software engineering is critical to all NASA strategic enterprises, yet as a discipline, it is still relatively immature and, moreover, it is constantly evolving. In addition, NASA is confronted with increasing levels of system sophistication and complexity. In order to reliably control and safely operate these systems, a greater dependency is being placed on software. Software Assurance is NASA's software risk mitigation strategy. No matter what organization may perform each of the many tasks of software assurance -- safety, quality, reliability, maintainability, process analyses, product analyses, independent verification and validation, etc. – they all must be taken into account, scoped, tailored, and balanced for each project. This program was originally put in place to address NASA's continual need to be current in the assurance techniques and methodologies to best determine and provide appropriate software risk mitigation. The program is to respond to both practitioners identified needs and to look ahead to prepare for new ways to understand and prevent hazards and provide greater quality at a reasonable cost. Recent incidents have shown that software reliability and safety are as critical to mission success as hardware safety and reliability. Consistent, proven methods needed for managing, developing, testing, analyzing, and certifying software need to be continually explored and developed. As the techniques and methods for developing, testing, implementing, and operating software are constantly changing, there needs to be an on going study of how best to assure the quality, safety and reliability of that software. The ever growing complexity of NASA's software, both organizationally and technically, means that software failure modes and reliability are more difficult to evaluate. NASA needs to explore the basic understanding of changing software principles and how to assure them, and then develop, test, and implement the tools, methods, and processes needed to uncover, analyze and address software defects at their root cause.

1.3. Program Goal

The goal of this research program is to provide NASA with the software assurance practices, methods, and tools needed to produce safe and reliable software. This program is designed to address fundamental software assurance problems in the field of software engineering primarily as it relates to software safety, quality, independent verification and validation (IV&V), testability, and reliability. It is intended to develop and transfer to NASA projects, software assurance practices, methods and tools to improve the quality of the software produced by and for NASA, and to assist NASA in becoming a leader in the development of safe and reliable, cost effective software. Thus, by addressing forward

thinking research as well as addressing current needs, the OSMA SARP helps assure that sufficient and appropriate software risk mitigation is applied to the software which controls and monitors our systems.

1.4. Program Objectives

The objectives of the OSMA Software Assurance Research Program are to:

Support promising new software assurance research that facilitates NASA missions; identify, develop, adopt, and integrate software assurance "best practices" and research results into NASA programs to reduce software costs; improve delivery time; and, increase software safety and quality. Technological transfer to improve NASA programs and assist outside organizations is also a component of the SARP.

1.5. Implementation Strategy

To meet the goal and objectives, the OSMA sponsors the SARP through the NASA Independent Verification and Validation (IV&V) Facility in Fairmont WV. The IV&V Facility assists OSMA in the research selection as well as the technical and management oversight of the awarded research initiatives.

1.5.1. Initiative Life Cycle

The OSMA SARP operates on an approximate annual cycle. Nominally, this plan is completed in January; proposals are solicited in March, received in June, selected in August, awarded in January and managed to completion. The following Gantt chart illustrates the initiative life cycle.

ID	Task Name	2004						
		1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter
		Jan	Apr	Jul	Oct	Jan	Apr	Jul
1	Plan program	■						
4	Solicit proposals	■	■					
8	Select proposals		■	■	■			
15	Award initiatives			■	■	■	■	■
20	Manage research				■	■	■	■
89	Conduct Symposium			■				

1.5.2. Who needs to propose

Only proposers of new research initiatives need to submit a proposal. Program participants that have an existing OSMA SARP funded research contract or grant whose period of performance extends into FY04 or later need not submit a proposal.

Contracts or grants can be multi-year but are only funded a year at a time. Beginning in FY04, program participants that have an existing OSMA SARP funded research contract or grant whose period of performance extends into FY04 or later need not submit a proposal. Formerly, to get funding, all program participants were required to submit a proposal every year regardless of whether they had an existing contract or grant whose period of performance hadn't expired.

1.5.3. Solicitation Instruments

The OSMA SARP uses this Level I Program Plan to solicit participation by NASA Center personnel. To solicit proposals from universities and industrial organizations, the OSMA SARP uses an annual NASA Research Announcement (NRA) for Software Assurance Research.

1.5.4. Proposal Format

The same format is used for both proposals in response to this Level I plan and for proposals in response to the NRA. A proposal template is included in Appendix A of this document.

1.5.5. Award Types

Typically, initiatives are awarded as grants, contracts, or internal fund transfers. NASA awards grants to universities and contracts to industry through the annual NRA. A cooperative agreement or other agreement may also be used to fund an effort in response to this plan or the NRA. In those cases where a contract vehicle is already in place or the work is to be done by civil servants, Code Q transfers funds directly to the IV&V Facility or appropriate NASA Center *via* a Form 506.

1.5.6. Number of Awards

The program anticipates supporting approximately 25 initiatives in FY04. These 25 initiatives will be comprised of new initiatives and continuing initiatives. As stated in section 1.5.2 above, OSMA SARP management will evaluate the current initiative performance during the year to determine subsequent year funding. The number of FY04 awards will depend on the budget available after funding the continued initiatives from previous years.

1.5.7. Grant and Contract Period of Performance

Grants and contracts can be for single or multiple years. Typical periods of performance range from one year to three years. Multiple year contracts will have a base year with annual options.

Each year, the OSMA SARP will decide whether to continue funding multi-year grants or contracts. The decision whether to continue will be based on initiative performance including progress on deliverables and transfer of results to NASA software projects.

1.5.8. Funding Increments

For NASA Centers, Headquarters transfers funds directly to the centers through normal methods. All funds are designated UPN 323.

For each grant or contract, NASA will normally process only one procurement request each year. When multi-year projects are supported, researchers should plan to carry over 15-25% of their annual funding through the first quarter of the next fiscal year so as to support work done in the October through December time frame.

Once NASA awards the research initiative grants or contracts, the OSMA SARP management will evaluate the initiative performance during the year to determine subsequent year funding. The funding decisions will be based on initiative performance including progress on deliverables and transfer of results to NASA software projects.

1.5.9. Research Topics

The OSMA SARP is seeking research in selected topic areas. The topic areas can be found at the OSMA SARP web page: <http://www.ivv.nasa.gov/business/research/SARP/index.shtml>. Proposals outside these topic areas will also be accepted provided that the results of the proposed work will contribute to accomplishing the program goal and objectives.

1.5.10. Evaluation Criteria

Consistent with the above goal, objectives and strategy, research initiatives will be selected and funded based on the following criteria:

1. Relevance to software safety and mission assurance

How significant will be the contribution of the research results to the fielding of safe and reliable software to support NASA Missions? Does it address any recognized areas of concern or need for NASA software engineering, management, safety, or assurance.

2. Clarity of objectives

How well did the proposer define the objectives of the proposed work? How specific and measurable are the objectives? Will an observer be able to clearly determine that an objective has been satisfied?

3. Feasibility of methods and procedures

What's the likelihood that the proposer will be able to implement the proposed research methods and procedures within resource constraints? How likely are the proposed methods and procedures to result in accomplishing the proposed objectives?

4. Potential for technology transfer to NASA software projects

How likely are NASA software projects to use the results of the proposed research? How likely are the proposed results to be applicable to situations beyond the scope of the original research? How well does the proposed research address issues that would likely be encountered in other programs? How well does the proposer identify other NASA program(s) or strategic enterprise(s) that could apply the proposed research results? How well does the proposer show how other NASA program(s) or strategic enterprise(s) would apply the knowledge gained from the research?

5. Clarity of success criteria and progress metrics

How well does the proposer define the conditions for success? How much interpretation will be required to know if the initiative was a success? How well does the proposer define how they will measure, track and report progress toward achieving success? Are there sufficient clear interim objectives to determine progress and the extent to which the overall objectives are being achieved?

6. Value of the proposed research for the estimated cost

How much are the research results worth compared with the estimated cost?

7. Uniqueness of proposed research

To what degree is the proposed research distinctive from other current and past, valid research? Do the investigator(s) demonstrate knowledge of other research relating to the proposed research? Do they clearly identify the differences between their research and similar or related research?

8. Qualifications of the research team to do the proposed research

How qualified are the members of the proposed research team to carry out the proposed research? How relevant are their capabilities, experience, and facilities relevant to the proposed area of research? How well qualified is the Principal Investigator or team leader?

9. Past performance of the research team (where available)

How has the research team performed on past research projects? How did their actual deliverables compare with their planned deliverables? How many periodic reviews did they plan and how many did they actually conduct?

10. Overall quality of proposed initiative

Considering all of the above factors, how good is the proposal?

1.5.11. Criteria Weighting

Relevance to software safety and mission assurance (criterion 1), potential for technology transfer to NASA software projects (criterion 4), and the overall quality of the proposed initiative (criterion 10) will be weighted twice as much as the other criteria.

1.5.12. Proposal Scoring

Proposals will be evaluated using a five-point scale for each criterion. Concerning criterion 9 – past performance of the research team, if the proposed research team has not performed previous OSMA SARP research projects, this criterion will receive a score of 3 points.

2.0 AUTHORITY

James D. Lloyd, the OSMA Deputy Associate Administrator, oversees the SARP. He establishes research objectives, approves the results of the Source Evaluation Board (SEB), and delegates the administrative management of the SARP to the IV&V Facility.

3.0 ROLES AND RESPONSIBILITIES

3.1. NASA's Strategic Enterprises

Aerospace Technology, Human Exploration and Development of Space, Biological and Physical Research, Earth Science, and Space Science have projects that benefit from the project application of the tools, techniques, methods, and processes developed through the OSMA software program. Any software research conducted under the auspices of the Enterprises, are invited to collaborate and exchange findings with the SARP. They should contact the NASA Software Assurance Manager to facilitate this exchange.

3.2. Deputy Associate Administrator Office of Safety and Mission Assurance (OSMA) (Code Q)

Code Q is the immediate customer for this research. Code Q provides the funding and delegates the implementation responsibility for the program to the NASA IV&V Facility. Code Q provides the Level I plan to Code B. In addition to funding the software assurance research, Code Q funds the annual Software Assurance Symposium that showcases the research results.

The OSMA Deputy Associate Administrator is the Source Selection Official (SSO) and as such has source selection authority for the NRA. The SSO commissions a Source Evaluation Board to evaluate proposals and provide recommendations for selection.

3.3. OSMA Software Assurance Manager

The OSMA Software Assurance Manager (Martha Wetherholt, martha.s.wetherholt@nasa.gov) in Headquarters Code Q, participates in the selection of research, addresses Headquarters level budget issues, and periodically reviews the program status. The OSMA Software Assurance Manager works with the IV&V Facility to develop the Level I plan and NRA, works with the IV&V Facility to develop the Level II plan, conducts periodic reviews with the IV&V Research Lead, and participates in the coordination and arrangement of the Software Assurance Symposium.

3.4. Chief Financial Office (Code B)

Code B distributes the Level I plan to the NASA Centers to communicate the plan to the Centers and to alert the Centers to the NRA.

3.5. Source Evaluation Board (SEB)

The Source Evaluation Board evaluates proposals in response to both the Program Operating Plan (POP) call and the NRA and provides recommendations to the SSO. The SEB also evaluates the performance of on-going research initiatives and provides continuation and funding recommendations for them to the OSMA Deputy Associate Administrator.

The SEB will include at a minimum three individuals: a HQ OSMA representative, an IV&V Facility representative, and a third individual from a yet to be determined entity.

3.6. Goddard Space Flight Center (GSFC)

GSFC is the administrative office for the NASA Research Announcement that is used to solicit proposals from universities and industrial organizations. GSFC procurement personnel serve as contracting officers for awards to universities and industrial organizations.

3.7. NASA IV&V Facility

The IV&V Facility manages the OSMA Software Assurance Research Program for OSMA. In cooperation with the OSMA Software Assurance Manager, the IV&V Facility drafts the Level I Technical Program Plan and the NRA. The Level I plan (this document) serves as a call for NASA Center proposals. The NRA serves as a call for proposals from universities and industry. GSFC procurement issues the NRA.

Proposals are submitted to the OSMA SARP Web-based data repository that the IV&V Facility maintains. Upon receiving proposals, the IV&V Facility notifies the SSO and the OSMA Software Assurance Manager.

The SSO instructs the SEB to evaluate the proposals.

The SEB may contact members of the NASA Software Working Group (SWG) to assist in proposal evaluation. The IV&V Facility provides administrative and technical support to the SEB. The SEB evaluates the proposals and provides recommendations to the SSO.

The SSO selects proposals for award. For successful university or industry proposals, GSFC procurement establishes appropriate instruments, such as grants or contracts.

The IV&V Facility, in coordination with the OSMA Software Assurance Manager, prepares a Level II Operating Plan incorporating the recommendations from the SEB. The OSMA Deputy Associate Administrator's signature on the completed Level II Plan constitutes selection of proposals. The Level II Plan contains a list of the proposals selected for award. The Level II Plan also contains center-level funding distribution. (Note that the Level I plan can cover several fiscal years while the Level II Plan, which contains adjusted center-level funding, covers only the upcoming fiscal year.)

Once the period of performance has begun, the IV&V Facility conducts quarterly program management reviews with each principal researcher. The IV&V Facility Research Lead is Kenneth McGill (304-367-8300, Kenneth.McGill@ivv.nasa.gov). The IV&V Facility will present an informal monthly report to the OSMA Software Assurance Manager concerning the state of the research.

The IV&V Facility maintains a Web-based repository of initiative research results that have been approved for public dissemination by NASA. The IV&V Facility conducts, for OSMA, an annual symposium, usually in West Virginia, to provide a forum for the initiative principal investigators to present their research results to OSMA and to their peers. Attendance of all SARP principal investigators is required.

3.8. Software Working Group (SWG)

The SEB may request the SWG to evaluate proposals. Software Working Group members or their designees evaluate the proposals using templates and a process that the IV&V Facility establishes in the Web-based data repository. The IV&V Facility compiles the evaluation results and provides them to the SEB.

3.9. NASA Centers

All NASA Centers are invited to participate in this program. NASA individuals and organizations that wish to propose should draft a proposal. The proposal provides the information required by HOWI 7410-Q030, OSMA Budget Formulation, Appendix B. The proposal format is included in Appendix A of this document. It can also be downloaded from the OSMA SARP web page at <http://www.ivv.nasa.gov/business/research/SARP/index.shtml>.

Contact the IV&V Facility Research Lead, Ken McGill, for more information.

3.10. Universities and Industry

Universities and industrial organizations already working in conjunction with a NASA Center or directly with the IV&V Facility can propose as a center initiative through their sponsoring NASA organization. For universities and industrial organizations not associated with NASA, the GSFC procurement office will post the NRA for Software Assurance Research in the Commerce Business Daily (CBD) and the NASA Acquisition Internet Service (NAIS). The NRA can also be downloaded from the OSMA SARP web page at <http://www.ivv.nasa.gov/business/research/SARP/index.shtml>

3.11. Principal Investigators (NASA, University and Industry)

Principal Investigators are responsible for scheduling and executing quarterly reviews with the IV&V Facility. Researchers will be required to give a quarterly status report on their initiative(s), and will be required to present their findings at an annual symposium in West Virginia. The FY03 symposium is July 30 – August 1, 2003 at the Lakeview Resort and Conference Center in Morgantown, WV.

4.0 RESOURCE PROJECTIONS

The projected annual resources for the OSMA SARP are approximately 4.6 million dollars. These funds will be distributed approximately as follows.

66%	Center Initiative at NASA Centers and the IV&V Facility
7%	New University and Industry Research through the NRA process
15%	West Virginia University
12%	Contract Support and Management Overhead

5.0 ACRONYMS

CBD	Commerce Business Daily
FY	Fiscal Year
GSFC	Goddard Space Flight Center
HO	Headquarters
IV&V	Independent Verification and Validation
NAIS	NASA Acquisition Internet Service
NASA	National Aeronautics and Space Administration
NRA	NASA Research Announcement
OSMA	Office of Safety and Mission Assurance
POP	Program Operating Plan
SARP	Software Assurance Research Program
SEB	Source Evaluation Board
SMA	Safety and Mission Assurance
SSO	Source Selection Official
SWG	Software Working Group